

**DETAILED ACTION**

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claim 35, 37, and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wakita et al (JP 2000-335998), where an Computer Translation (CT) is provided, in view of Loxley et al (US 4,072,489) and Loxley et al (US 2002/0152768).

Wakita et al teaches adhering a slurry of silica powder on an outside surface of a quartz crucible (CT [0010]). Wakita et al teaches applying the silica powder to areas in contact with a carbon crucible member (CT [0021]).

Wakita et al does not explicitly teach the whole outside is coated. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wakita et al

by coating the whole outside to be used a carbon crucible which surrounds the quartz crucible.

Carbon crucible which surround the quartz crucible are conventional known and taught by Wakita in Fig 4.

Wakita et al does not teach the claimed silica particle size distribution.

In a method of forming a porous silica crucible, note entire reference, Loxley et al teaches the optimum size of the silica particles used depends somewhat on the type of process employed and the type of article being formed (col 6, ln 1-25). Loxley et al also teaches significant advantages can be obtained by employing a mixture of silica particles of different sizes and the average particle size is preferably between 1 and 10 microns (col 6, ln 1-25). Loxley et al teaches the best results are obtained by using small particles since this facilitates removal of water in the vacuum furnace (col 6, ln 1-25). Loxley et al also teaches small amounts of large particles can sometimes be tolerated and the particle size is preferably no greater than 100 microns when making silica crucibles (col 6, ln 20-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wakita by using silica particles having a particle size from 1-10 microns, as taught by Loxley et al, because a range of 1-10 microns is known to produce good crucibles by facilitating removal of water (col 4, ln 20-31 and col 6, ln 1-35).

As to the fine silica particles constitute 20-68 weight % of all silica powder glass and have particle size of smaller than 10  $\mu\text{m}$  and coarse silica constitute the remaining silica glass and have particle sizes from 10-150  $\mu\text{m}$ , the combination of Wakita et al and Loxley et al teaches particles from 1-10 microns and large particles less than 100 microns can sometimes be used

('489 col 1-35). The range from 1-10 micron overlaps the range for fine and coarse particles claimed by applicant's because 10 microns reads on applicant's coarse silica glass particles.

The combination of Wakita et al and Loxley et al does not explicitly teach the weight ranges for fine and coarse particles.

In a method of forming silica performs for Czochralski furnaces (Abstract), Loxley et al ('768) teaches a particle size distribution to improve the wet strength of the silica preform and obtain the desired porosity in the range of 15-20 volume percent using a particle size distribution by weight of 10-15% from 20-30 microns, 40% or more from 6-20 microns, 20-40% from 1-6 microns and 3-10% below 1 microns ([0084]-[0088]). The ranges taught by Loxley et al overlap the ranges claimed by applicant, and overlapping ranges are *prima facie* obvious (MPEP 2144.05).

Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wakita et al and Loxley et al ('489) with Loxley et al ('768) particle size distribution which is known to improve the wet adhesion strength and obtain the porosity desired by Loxley et al ('489) (See '489 col 7, ln 35-40 and '768 [0084]) in view of Loxley et al ('489) teaching that advantages can be obtained from mixture of particles of different sizes ('489 col 6, ln 1-15).

Referring to claim 48, Wakita et al teaches a binder layer in which solvent is volatilized from the slurry layer (CT [0024]). Wakita et al does not teach the solvent is an organic substance. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wakita et al, Loxley et al ('489) and Loxley et al ('768) by using an organic solvent because there is a limited number of selections (organic or

inorganic); therefore use of an organic solvent would have been obvious. Furthermore, selection of a known material based on its suitability for its intended purpose is *prima facie* obvious (MPEP 2144.07); therefore the selection of a organic solvent to act as a solvent would have been obvious to one of ordinary skill in the art at the time of the invention.

Referring to claim 49, the ranges for the coarse silica particles overlaps the ranges taught by Loxley et al ('768), as discussed previously.

3. Claim 35, 37-41, 43-47 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hansen et al (US 5,976,247) in view of Watanabe et al (US 6,106,610), Loxley et al (US 4,072,489) and Loxley et al (US 2002/0152768)..

Hansen et al discloses a quartz glass crucible comprising a layer of metal oxide, wherein the layer is baked on at least a portion of an inside **26** and outside **24** surface of the silica crucible main body **10** (col 5, ln 10-60; col 7, ln 25-67 and col 8, ln 15-50; and Fig 2). Hansen et al discloses an aqueous solution of barium oxide is used and the solution is sprayed onto a crucible that is heated to 200-300°C, and devitrification promoters create nucleation sites as the crucible is heated to the melt temperature (baking) (col 6, ln 55-57 and col 7, ln 25-65).

Hansen does not teach a silica glass powder layer formed on the whole or in a ring configuration on the outside surface of the crucible main body and/or in a ring configuration on an upper end portion of the inside surface of the crucible main body. However, Hansen et al is not particular about the method used to coat the surface of the crucible.

In a method of forming a crucible, note entire reference, Watanabe et al teaches a crystallization promoter can be used either alone or as a mixture with a powder of synthetic

silicon dioxide to form a translucent quartz glass layer. Watanabe et al teaches depositing a synthetic silicon dioxide powder sufficiently impregnated with the aqueous solution, and the layer is formed as a coated film or a solid solution layer on the surface (col 3, ln 30-65 and col 4, ln 1-35), this clearly suggests a silica glass powder layer. Watanabe et al also teaches a crystallization promoter layer is fused to a base body (col 5, ln 5-30). Watanabe et al also teaches a transparent internal quartz layer (col 5, ln 55-67).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Hansen et al by fusing the layer with a crystallization promoter dispersed in a silica matrix (silica powder) to the base body as taught by Watanabe et al, to improve adherence and improve safety by reducing the risk of inhalation and ingestion of the promoter ('247 col 7, ln 40-55).

The combination of Hansen et al and Watanabe et al does not teach the claimed silica particle size distribution.

In a method of forming a porous silica crucible, note entire reference, Loxley et al teaches the optimum size of the silica particles used depends somewhat on the type of process employed and the type of article being formed (col 6, ln 1-25). Loxley et al also teaches significant advantages can be obtained by employing a mixture of silica particles of different sizes and the average particle size is preferably between 1 and 10 microns (col 6, ln 1-25). Loxley et al teaches the best results are obtained by using small particles since this facilitates removal of water in the vacuum furnace (col 6, ln 1-25). Loxley et al also teaches small amounts of large particles can sometimes be tolerated and the particle size is preferably no greater than 100 microns when making silica crucibles (col 6, ln 20-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hansen et al and Watanabe et al by using silica particles having a particle size from 1-10 microns, as taught by Loxley et al, because a range of 1-10 microns is known to produce good crucibles by facilitating removal of water (col 4, ln 20-31 and col 6, ln 1-35).

As to the fine silica particles constitute 20-68 weight % of all silica powder glass and have particle size of smaller than 10  $\mu\text{m}$  and coarse silica constitute the remaining silica glass and have particle sizes from 10-150  $\mu\text{m}$ , the combination of Hansen et al, Watanabe et al and Loxley et al teaches particles from 1-10 microns and large particles less than 100 microns can sometimes be used ('489 col 1-35). The range from 1-10 micron overlaps the range for fine and coarse particles claimed by applicant's because 10 microns reads on applicant's coarse silica glass particles.

The combination of Hansen et al, Watanabe et al and Loxley et al does not explicitly teach the weight ranges for fine and coarse particles.

In a method of forming silica performs for Czochralski furnaces (Abstract), Loxley et al ('768) teaches a particle size distribution to improve the wet strength of the silica preform and obtain the desired porosity in the range of 15-20 volume percent using a particle size distribution by weight of 10-15% from 20-30 microns, 40% or more from 6-20 microns, 20-40% from 1-6 microns and 3-10% below 1 microns ([0084]-[0088]). The ranges taught by Loxley et al overlap the ranges claimed by applicant, and overlapping ranges are *prima facie* obvious (MPEP 2144.05).

Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hansen et al, Watanabe et al and Loxley et al with Loxley et al ('768) particle size distribution which is known to improve the wet adhesion strength and obtain the porosity desired by Loxley et al ('489) (See '489 col 7, ln 35-40 and '768 [0084]) in view of Loxley et al ('489) teaching that advantages can be obtained from mixture of particles of different sizes ('489 col 6, ln 1-15).

Referring to claim 37-41, the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768) teaches coating the entire inner, or the inner except the bottom, coating the outer and coating the outer with the bottom wall uncoated ('629 Figs 1-2; col 5, ln 30-67 and col 7, ln 65-67).

Referring to claim 43, the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768) teaches a particle size distribution satisfying the relationship of applicant's claim36; therefore the particle distribution is expected to enable the control of shrinkage percentage of the silicon glass powder layer to be less than 10% at the time of sintering.

Referring to claim 44, the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768) teaches a high density silica glass; therefore clearly suggests a density more than 1 mg/cm<sup>2</sup>.

Referring to claim 45, the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768) teaches a crystallization promoter layer small than 0.3 mm ('610 col 3, ln 1-45), overlapping ranges are prima facie obvious (MPEP 2144.05).

Referring to claim 46, the combination of Hansen et al and Watanabe et al teaches synthetic silicon dioxide (silica) powder (610 col 3, ln 30-45).

Referring to claim 47, the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768)teaches an internal layer 4 of pure synthetic silicon dioxide ('610 col 5, ln 25-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Hansen et al, Watanabe et al, Loxley et al ('489) and Loxley et al ('768) by using a synthetic silica have a metal concentration less than 1 ppm to prevent contamination to the contents of the crucible during use. Furthermore, the mere purity of a product, by itself, does not render the product unobvious (MPEP 2144.04).

*Response to Arguments*

4. Applicant's arguments with respect to claims 35-48 have been considered but are moot in view of the new ground(s) of rejection.

*Conclusion*

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Werdecker et al (US 2003/0041623) teaches a tamped volume of at least 0.8 g/cm<sup>3</sup> for a transparent silica glass layer of a crucible (Abstract).

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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October 26, 2009

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